SECTION 9

Alternatives

This section identifies and evaluates a range of reasonable alternatives to the proposed Modesto Irrigation District (MID) Electric Generation Station (MEGS). This section includes the following:

- **Section 9.1—No Project Alternative.** Provides information on what would occur if the alternative is selected, which would not include developing a new power generation facility
- **Section 9.2—Proposed and Alternative Sites.** Provides information on the locations for constructing and operating MEGS and the site selection criteria used in determining the proposed location of MEGS
- **Section 9.3—Alternative Linear Facility.** Provides information on the linear facilities (electric, natural gas, and water) required for MEGS
- **Section 9.4—Alternatives Wastewater Discharge.** Provides information on the alternative configurations to the combustion turbines currently proposed for MEGS
- **Section 9.5—Alternative Project Configurations.** Provides information on alternative power generation technologies
- **Section 9.6—Alternative Technologies.** Provides information on the other technologies considered using the selection methodology
- **Section 9.7—References.** Provides references used in preparation of Section 9

9.1 No Project Alternative

9.1.1 Description

If the No Project Alternative were selected, MID would not receive authorization to construct and operate a new power generation facility. Therefore, the proposed facility site would not be developed and would remain in its present condition. Peaking energy that would have been produced by the proposed facility would need to be generated by another available source. Common available sources include older peaking generation facilities that consume more natural gas and release larger quantities of air pollutants. In addition, under this alternative, California and the Western Interconnection would have less peaking capacity, and therefore, a less reliable electric system.

The No Project Alternative is not considered feasible because it does not meet the project's objectives in the energy market. In addition, the No Project Alternative does not meet MID's business plans for the development of new power generation facilities to meet customer load and provide ancillary services to the power grid.

9.1.2 Potential Environmental Impacts

Implementation of MEGS would produce electricity to serve the demand created by MID's ratepayer-owners. MEGS would also consume less fuel and discharge fewer air emissions for each megawatt (MW) hour generated when compared to other existing, older fossil fuel peaking generation facilities (diesel generator sets). This is a beneficial environmental impact.

Potential environmental impacts from the No Project Alternative would result in greater fuel consumption and air pollution because new peaking generating facilities, including MEGS, would not be brought into operation to displace production from older, less efficient, higher air emissions peaking power plants.

9.2 Proposed and Alternative Sites

MID has adopted a strategy, as a fully integrated public electric utility, of serving industrial, commercial, and residential customers in and around Modesto, California, and neighboring areas in Stanislaus and San Joaquin Counties. Due to increasing electric load demand within its service territory and anticipated new load that the District is committed to serve, MID's Board of Directors has resolved to meet future load demands with a mixture of resources, including up to 95 MW of new local peaking capacity from MEGS.

An evaluation of alternative sites was conducted as a part of developing the MEGS facility. In this study, 27 sites within a 30-mile radius of Modesto, California, were identified. These 27 sites were screened down to 16 sites, and eventually screened down to 3 sites. The paring was based on suitability criteria including site availability, size, and land use; proximity to transmission, fuel, and water and wastewater sources; and compatibility with the project, traffic, noise, and potential visual impacts. The infrastructure available at each site was also evaluated. As a part of the MEGS alternatives analysis, MID re-evaluated the sites previously considered for the Woodland Generating Station 2 in terms of their suitability for MEGS. MID added the McClure site to those considered for MEGS. (See Section 9.0 of the Woodland Generating Station 2 Small Power Plant Exemption Application.)

9.2.1 The Proposed Site

The MEGS site is located in Section 30, Township 3S, Range 9E, in an industrial area of the City of Ripon (City), adjacent to the City's wastewater treatment plant and approximately 0.25 mile from the existing MID Stockton substation. The plant would be within a fenced area at the intersection of the future extensions of South Stockton Avenue and Doak Boulevard. The MEGS facility would occupy approximately 8 acres within a 12.25-acre area for which MID has obtained a purchase option. The plant would occupy approximately 6 acres near the northern side of the site (see Figure 2-1). An additional 2 acres would be needed for primary and emergency access to the plant and transmission lines. The remaining 4.25 acres would be used for equipment laydown and parking during construction.

9.2.2 Alternative Sites

MID also identified and assessed the suitability of several other properties for MEGS. MID evaluated 16 other properties as a part of the alternative site analysis. Based on the requirements for the MEGS facility, three properties were considered for further analysis.

Figure 9-1 (all figures located at the end of this section) identifies the location of the alternative sites that were evaluated during the site selection process.

9.2.2.1 Alternative Site Selection Criteria

The criteria developed to evaluate the alternative site suitability for MEGS correspond with the reasons the proposed site was selected. These criteria are as follows:

- Location of the site within MID's service territory
- Adequate size and shape to contain the proposed facilities and other site improvements
- Compatibility with local land use plans and zoning ordinances
- Compatibility with existing land uses and the presence of site improvements
- Availability of water, electric, and natural gas interconnections
- Potential for less than significant environmental impacts (e.g., biological, cultural/paleontological, visual, noise, flooding, and seismic)

The alternative site locations, shown on Figure 9-1, were evaluated using the above criteria. The characteristics of each alternative site are presented in Table 9.2-1.

TABLE 9.2-1
Site Selection Criteria

Alternative Site	Site Size	Zoning Designation	Current Land Use/ Improvements
Site 1 (Riverbank Southeast)	37 acres	General Agriculture	Adjacent to Riverbank Army Ammunition Plant, near the City of Riverbank, Stanislaus County
Site 2 (McClure Substation North)	5.5 acres	Industrial	Adjacent to McClure Generating Station, City of Modesto, Stanislaus County
Site 3 Guntert Steel Site	7 acres	Industrial	Adjacent to Guntert Steel Company and Highway 99 in Ripon, California

9.2.2.2 Alternative Site Description and Feasibility

This section describes and analyzes each of the alternative sites based on its feasibility for use. Section 9.2.2.3 presents the environmental considerations.

Site 1. Riverbank Southeast is a parcel located on Cabribel Road in Stanislaus County, adjacent to the Riverbank Army Ammunition Plant near the City of Riverbank. The parcel is undeveloped agricultural land. West of the parcel is the Riverbank Army Ammunition

Plant, which is currently being used to produce military ammunition with other facilities on the installation being leased to various industrial clients. The areas to the north, east, and south contain agricultural lands and scattered residences. The nearest residence is located approximately 200 feet from Site 1.

Site 2. The McClure site is a 5.5-acre site that is presently occupied by the McClure Generating Station. The site is located in the southeast area of the City of Modesto in an industrial park and is zoned for industrial use. However, this location is approximately 0.3 miles from residential areas (to the north). This site has two GE Frame 7 generating units that are used for peaking power and is not staffed around the clock. Although the area around the site is developed, there is some vacant land that could be used for construction laydown and parking.

Site 3. The Guntert Steel site is a 7-acre parcel located in the industrial area of Ripon, California, between the Guntert Steel Company (on the west) and Highway 99 (to the east). The site is located east of MID's Stockton Substation. To the south of the site is the Ripon Cogeneration, Inc. plant and Fox River Paper Company. To the north are other industries. Because industrial development surrounds the site, assuming 6 acres is needed for the plant site, only 1 acre would be available for a construction laydown area. The closest residences are directly across Highway 99.

9.2.2.3 Environmental Considerations

This section discusses the potential environmental impacts of the alternative sites in relation to the proposed site. Potential environmental impacts from use of the proposed site are presented in each of the 16 environmental subsections of Section 8.0 of the Small Power Plant Exemption (SPPE) Application.

Air Quality

The type and quantity of air emissions from the proposed and 3 alternative sites would be identical because the plant would be the same at all locations. However, the impacts on the human population and the environment would differ because of the location of residences and other human habitat in the vicinity of the sites and the terrain surrounding the alternative sites. All air impacts would be reduced to a less than significant level through plant design and acquisition of emission reduction credits.

Biological Resources

Biological resources present at alternative Site 1 are of a higher quality and value than those on the proposed MEGS site due to the agricultural uses in the area. While not entirely natural, this site can support small mammals, ground-nesting birds, and the raptors that prey on them. Even without nesting trees, such parcels provide valuable foraging habitat for a variety of fauna. Sites 2 and 3 are in the middle of an industrial park and offer very low biological resource value. However, biological impacts could be mitigated to a less than significant level at each of these sites.

Cultural Resources

The potential of impacting cultural resources is similar at the proposed site and alternative sites. None of these sites are located in areas that appear to be highly sensitive from a cultural resource perspective. Implementation of proper mitigation measures would allow cultural resource impacts to be mitigated to a less than significant level.

Land Use
Table 9.2-1 shows the zoning of the sites. Sites 2 and 3, like the proposed site, are zoned industrial and would have appropriate zoning for a power plant. However, Site 1 is zoned agricultural and would likely require a change to the General Plan and zoning ordinance, or require other entitlements, to be a suitable location for a power plant.

Noise
The proposed project site and alternative sites are located in sparsely populated or industrial areas. However, residential areas are within 200 feet of Site 1 and 0.3 mile of Site 2. The proposed site is 0.3 miles from the nearest residential areas. However, future industrial development is slated for the vacant land immediately west of the project site. This development would lie between the residential area and would buffer any project noise. The closer proximity of Sites 1 and 2 to sensitive receptors could result in greater noise impacts compared to the proposed site. The closest residential area to Site 3 is located 0.2 miles to the east, across Highway 99. However, the noise generated from Highway 99 acts as a sound curtain, which would decrease the noise impact from Site 3.

Public Health
Alternative Sites 1 and 2 are significantly closer to a larger number of public receptors than the proposed site. Therefore, these sites would likely expose the public to greater public health impacts than the proposed site, although all three sites would still be below a level of significance. Site 3, located near the highway, would have lower ambient air quality. Therefore, there may be a potential cumulative public health impact from the power plant combined with the ambient freeway air.

Worker Health and Safety
As described in the Section 8.7, construction and operation of MEGS would not have an adverse impact on worker health and safety. The worker health and safety impacts from the proposed site and alternative sites are equivalent because the construction and operation of the plant would be the same at each location.

Socioeconomics
The socioeconomic impacts and benefits from the proposed site and alternative sites would be equivalent because the construction and operation of the plant would be the same at each location.

Agriculture and Soils
The proposed site is largely undeveloped land in an industrial area of the City of Ripon. The site has not been in agricultural use since 1997. Similarly, Sites 2 and 3 are located in industrial areas. Therefore, these locations would not result in the conversion of prime agricultural land. Alternative Site 1 is located on undeveloped agricultural land, surrounded by other agricultural lands. The plant only requires 6 acres. The conversion of less than 10 acres of agricultural land is considered a less than significant impact.

Traffic and Transportation
Traffic and transportation impacts would be comparable for the proposed project and the alternative sites. Each site has reasonably good access via all-weather roads, connecting to Highway 99. The proposed site and Sites 2 and 3 are particularly close to the Highway. Site 1 would have longer distances for road deliveries and potential effects on traffic. Neither

Sites 1 nor 2 are closer to all-weather roads, rail, and major highway access than the proposed site or Site 3. However, Site 3 does not have sufficient land available for construction laydown and parking. The construction laydown and parking area would have to be located away from the site, requiring workers and equipment to be shuttled to and from the laydown and parking area. This would presumably result in traffic congestion on the local roads between the site and the laydown area.

Visual Resources

The potential for visual resources impacts associated with each of these sites varies depending on the relative visibility of the sites from roads and residences and the length and potential visibility of any new transmission lines that development of a generating facility on the site would require. With the exception of Site 2 (McClure), none of the sites reviewed currently support uses that are consistent with the visual aspects of a power plant. The proposed site and Site 3 are in industrial areas and consistent with the existing visual character of the area. Although the proposed site is currently visible to residences located 0.3 miles from the site, the vacant industrial-zoned land immediately to the west of the project site will be developed in the future, providing screening of the power plant.

Site 3 is also located in an industrial area. Although a power plant would be consistent with the visual character of the industrial area, it would be visible from the backyards of the residences across the highway and motorists on Highway 99. Planting redwoods between the plant site and the railroad tracts (located between the plant site and Highway 99) would screen this site from both motorists and the residences on the other side of the highway.

Hazardous Materials Handling

The same quantity of hazardous materials stored at the alternative sites would be stored and used at the proposed site. The hazardous materials handling impacts and benefits from the proposed site and alternative sites would be equivalent because the construction and operation of the plant would be the same at each location.

Waste Management

The same quantity of waste generated at the alternative sites would be generated at the proposed site. The environmental impact of waste disposal should not differ significantly between the proposed and alternative sites.

Water Resources

Water is generally available at each of the alternative sites, and the impacts would generally be comparable between the proposed site and the alternative sites. However, Site 1 (Riverbank) would likely be more difficult to dispose of wastewater than the other two sites reviewed, which would make the water resources impacts somewhat higher.

Geologic Hazards and Resources

As described in Section 8.14, Geological Resources, the proposed site is located in seismic zone 3. The alternative sites are also potentially subject to the same geologic hazards. Therefore, the geologic hazard impact from the proposed site and the alternative sites is equivalent. Proper design of the plant and appurtenant structures would ensure that geological impacts would be less than significant.

Paleontological Resources

The proposed site and the alternative sites have the potential to adversely impact paleontological resources because of deep excavations in those areas where fill is not present. None of the sites have been disturbed by development or other activities. Therefore, all sites have an equivalent potential for the presence of paleontological resources. However, appropriate construction monitoring would reduce the potential impacts to a less than significant level.

9.2.2.4 Selection of the Proposed MEGS Site

The primary reasons for selecting the proposed MEGS site were its environmental acceptability, large lot size, and proximity to necessary infrastructure. This proximity has significant advantages over the alternative sites (except Site 3). In addition, the proposed site also has land available for construction laydown and parking, which Site 3 lacks.

Table 9.2-2 compares the potential environmental characteristics of the proposed MEGS site with Sites 1, 2, and 3. The proposed site location is more ideal than the alternative sites. In most cases, its impacts are the same as or, in some cases, less than the best alternative site. Site 1 may require land use entitlements that make it less desirable than the other sites. However, because the proposed site will require less development than most of its alternatives, the overall impact to the environment is likely to be lower. Moreover, environmental impacts from all of these sites (except Site 1, if land use entitlements are needed) could be mitigated to a level of insignificance.

TABLE 9.2-2
Environmental Characteristics of Alternative Sites

Characteristic	Proposed Site	Riverbank Site 1	McClure Site 2	Guntert Site 3
Potential presence of threatened or endangered species/ habitat	Maybe	Yes	Yes	Maybe
Potential cultural/ archaeological sensitivity	Maybe	Maybe	Maybe	Maybe
Potential land use incompatibility	No	Maybe	No	No
Proximity to sensitive noise receptors	Near residential area	Scattered residences	Near residential area	Near residential area (across Highway 99)
Risk to humans from deposition of air pollutants	Low	Low to moderate	Low to moderate	Low to moderate
Removal of prime agricultural land	No	Maybe	No	No
Traffic and transportation	Low	Moderate	Low	Moderate
Potential visual sensitivity	Low	Moderate	Low	Low
Potential for use of existing facilities	Yes	Yes	Yes	Yes
Risk to humans from offsite migration of hazardous materials	Low	Low	Low	Low
Potential paleontological sensitivity	Low to moderate	Low to moderate	Low to moderate	Low to moderate

9.3 Alternative Linear Facilities

Linear facilities required for MEGS include a 0.25 mile electric subtransmission line and fiber optic communications cable; a 0.25-mile natural gas pipeline; and potable, non-potable, wastewater discharge, sewer, and stormwater pipelines. The proposed linear facilities are presented in Section 2, *Project Description,* and Section 5, *Electric Transmission*. In addition, the environmental impacts of the proposed linear facilities are discussed in the various environmental sections. These linear facilities are short in length, which makes identifying alternative linear routes that have minimum environmental impacts virtually impossible. For instance, the subtransmission electrical line runs from the project site along an existing roadway to an existing MID substation. The natural gas line exits the project site to the east and runs approximately 0.25 miles north in South Stockton Avenue. The potable, non-potable, wastewater discharge, sewer, and stormwater lines would exit the project site and interconnect with the City's systems in South Stockton Avenue. Each pipeline would only be approximately 30 feet. Therefore, no alternative linear facilities are being proposed due to the short length of the proposed linear facilities and absence of feasible alternative routes with lower environmental impacts.

9.3.1 Water Supply

After discussions with the City of Ripon, MID determined that taking water from the City's non-potable water system, located on South Stockton Avenue adjacent to the project site, would be the preferable water source. This is a water supply provided by the City specifically for industrial uses. Furthermore, the City is exploring future options to augment the non-potable water supply with water from groundwater treatment facilities and recycled water (when available from the City's wastewater treatment plant).

The proposed alignment for a new pipeline would be at the edge of the project site where the City would stub-out the main line to its existing non-potable water system to be located in South Stockton Avenue. No significant impacts from this construction are evident.

9.3.1.1 Water Supply Alternatives

The State Water Resources Control Board Policy 75-58 specifies that to protect water quality and quantity, cooling water for power plants should come from the following sources (in order of preference):

1) Wastewater being discharged to the ocean
2) Ocean
3) Brackish water from natural sources or irrigation return flow
4) Inland wastewater of low total dissolved solids (TDS)
5) Other inland waters

The proposed MEGS facility would be more than 50 miles from the ocean, and therefore, the first two alternatives are not feasible. Similarly, there are no sources of naturally brackish water in the vicinity. The other alternatives were considered and are described below.

9.3.1.2 Inland Wastewater

Irrigation Return Flow

In some cases, irrigation return flow can be used for power plant cooling. The MEGS facility is located in Ripon, California, near various lateral canals that supply irrigation water to agriculture. The return flows from these agricultural uses are generally 5 miles or more from the project site, where they eventually flow into the San Joaquin River. Use of these irrigation return flows would require building a collection facility, a pump station, and at least 5 miles of pipeline to carry water back "uphill" to the facility from the irrigation return locations. The quality of the water would be poor, and would require additional treatment and clarification before use. In addition, more water would be needed because, due to the poor quality of water, the cycles of concentration would be lower.

Also, irrigation return water is only available during certain seasons of the year (approximately 8 months), and therefore, is unreliable. The proposed MEGS would need to have alternate supplies for the other times of year.

The cost of constructing two separate water supply infrastructures (irrigation water and alternate supply for when irrigation water is not available), along with the additional water treatment, greater volumes of blowdown, and potentially greater discharges to the sewer, make this option less preferable.

Recycled Wastewater

Recycled wastewater from the City's municipal wastewater treatment can be a suitable water supply for some power plants. The City has been developing a plan to implement wastewater recycling, but at present, no wastewater is available that meets Title 22 standards. When it becomes available, it most likely would originate at the City's nearby facility, approximately 0.25 mile south of the proposed site. Using this water supply would require a pumping rate of approximately 1,000 gallons per minute, requiring the installation of a new 10-inch-diameter underground high-density polyethylene pipeline. The design would also require installing two, 100 percent capacity raw water transfer pumps. The transfer pumps would be rated at approximately 125 horsepower.

The estimated present value cost of installing and operating the pipeline and necessary auxiliary equipment would be prohibitive. The City has stated to MID that wastewater that meets Title 22 standards is currently not available. Therefore, this potential source of plant raw water for cooling tower makeup is not considered a viable option, due to the lack of water availability, prohibitively high cost of construction and operation, and potentially adverse environmental impacts that could result from its implementation.

Other Inland Waters

As noted in Section 8.13, groundwater in areas of San Joaquin and Stanislaus Counties has historically been in overdraft, with withdrawals exceeding recharge. However, these localized overdrafts have not degraded the quality of groundwater under Ripon.

Using onsite potable groundwater would not be consistent with the City of Ripon's Ordinance 13.05, which requires the use of non-potable water when possible to conserve potable water supplies.

9.4 Alternative Wastewater Discharge

Several alternative wastewater discharge options were evaluated for this project. These alternative wastewater discharge options include the following:

- Surface discharge
- Zero-liquid discharge
- Dry cooling

9.4.1 Surface Discharge

Discharges to surface waters of the state would require permitting by the Central Valley Regional Water Quality Control Board under the National Pollutant Discharge Elimination System permitting program. The nearest surface waters to the site drain to the Stanislaus River, and from there to the San Joaquin River. The San Joaquin River is degraded because of nutrients, low flows, and high salt concentrations. Therefore, the Central Valley Regional Water Quality Control Board is unlikely to approve additional discharges to the river. Surface water discharges have the potential to directly affect aquatic biota, drinking water, and other beneficial uses designated for surface waters. Protecting these uses would require a high level of water treatment prior to discharge. Presently, the National Pollutant Discharge Elimination System dischargers must commonly meet a 500-mg/L TDS limit, which is significantly less than the concentration that is allowed under the proposed alternative. To meet the 500-mg/L limit, the proposed MEGS would not be able to recycle water to the extent presently proposed, and therefore, would require substantially more supply water and would have a higher quantity of water discharged. MID would also have substantial additional monitoring and compliance costs associated with this surface discharge permit. Based on these reasons, wastewater discharge to surface water was considered less preferable to the proposed discharge.

9.4.2 Zero-Liquid Discharge

By treating cooling tower blowdown and other process effluent with reverse osmosis, brine concentrators, evaporation ponds, or crystallizers, a power plant can achieve a zero-liquid discharge system. It has the advantage of making maximum use of water supplies, but requires substantial additional equipment, materials, and maintenance to implement. Reverse osmosis, brine concentrators, and crystallizers all result in a concentrated waste product, which may be determined to be hazardous waste and require specialized disposal. The cost of these technologies is relatively high when compared to the relatively small generating capacity of the proposed facility. The cost-benefit analysis for a zero-liquid discharge system would indicate that the proposed discharge alternative of onsite treatment and discharge to the City’s wastewater treatment plant would be economically and environmentally more efficient.

9.4.3 Dry Cooling

Alternative forms of cooling include a “dry” cooling system whereby the process heat loads are rejected to the atmosphere using air-cooled fin-fan heat exchangers. A “wet-dry” system is a hybrid of the evaporative cooling and dry cooling systems. The use of evaporative cooling is preferable to a dry cooling system or a wet-dry cooling system because of its lower capital cost, lower operating cost, and higher cycle efficiency.

Water consumption for the project could be reduced with a dry cooling system, reducing the amount of cooling water available to the facility. Use of the dry or wet-dry technology, although it may reduce water demand and wastewater discharge, could result in a shift in the types of impacts (such as air quality, visual resources, or noise) that the project might cause. Environmental considerations based on cooling system characteristics have been compared and presented in previous cases before the California Energy Commission (CEC). Staff has found that capital costs for dry cooling towers tend to be two to three times higher than wet systems in general (CEC, 2001). For hybrid systems that require the design and construction of two systems, costs can range from less than, to more than, dry cooling systems, depending on the system's ration of wet to dry in the design. In general, these initial cost differences are due to the heat exchanger unit, size of the structures needed, and the fans and motors needed for a given system.

9.5 Alternative Project Configurations

The proposed nominal 95-MW configuration of MEGS is the result of a variety of design and operating considerations. The main factors affecting the configuration include available gas turbine-generator sizes, economies of scale for both construction and operation of the plant, fuel supply logistics, power transmission capacities, and forecast market demand for electrical power. The proposed design configuration consists of the latest generation of commercially demonstrated combustion gas turbine technology.

MID conducted a study of the types of combustion turbine generators that would meet the objectives of the MEGS project, and concluded that the two GE LM6000 SPRINT combustion turbine generators would be most appropriate for MEGS.

9.6 Alternative Technologies

MEGS would provide electricity for its customer-owners. Therefore, MID would make efforts to keep its rates as low as possible. Other technologies were considered using the selection methodology described below, but were rejected in favor of the natural gas-fired, simple-cycle technology, which is the basis of this application.

9.6.1 Selection Methodology

Technologies considered were primarily those that could provide peak or intermittent power. The reason for using this screening criterion was MID's mission to keep rates as low as possible for its customer-owners. Two intermittent technologies with no fuel cost, solar and wind, were also examined to see if they might be economically viable.

The selection methodology included a stepped approach with each step containing a number of criteria. The selected technology would have to pass Steps 1 and 2 and provide the lowest or near lowest cost in Step 3. The steps are as follows:

Step 1. Commercial Availability—The technology had to be proven commercially practical with readily available, reliable equipment at an acceptable cost.

Step 2. Implementable—The technology had to be implementable; specifically, it could meet environmental, public safety, public acceptability, fuel availability, financial, and system integration requirements.

Step 3. Cost-effective—The technology had to be cost-effective, not only with existing peaking generating units. Cost included both capital and operation and maintenance costs, which would translate into a busbar cost represented in cents per kilowatt-hour.

The methodology was applied to a number of peaking electrical generation technologies in the following subsections.

9.6.2 Technologies Reviewed

The technologies reviewed can be grouped according to the fuel used. Fuels included were oil and natural gas, coal, nuclear reactions (usually using radioactive materials as fuel), water (hydro, ocean conversion, and geothermal), biomass, municipal solid waste, and solar radiation. However, due to the type of generating facility (a peaking facility) that MID is proposing, several technologies were immediately rejected due to the infeasibility of these technologies to provide cost-effective peaking electricity. These technologies were steam generator boilers that generated electrical power by passing steam through a steam turbine (including natural gas fired, coal fired, oil fired, biomass, and nuclear), hydroelectric, and ocean energy.

9.6.2.1 Oil and Natural Gas

These technologies use oil or natural gas and include combustion turbines in various configurations, and fuel cells. The description of these technologies includes the proposed alternative of a simple-cycle combustion turbine.

9.6.2.2 Simple Combustion Turbine

This technology uses a gas or combustion turbine to drive a generator. Air is compressed in the compressor section of the combustion turbine, passes into the combustion section where fuel is added and ignited, and the hot combustion gases pass through a turbine, which drives a generator and the compressor section of the combustion turbine. The combustion turbines have a relatively low capital cost with efficiencies approaching 40 percent in the larger units. Because the combustion turbines are fast starting and have a relatively low capital cost, they are used primarily for meeting high-peak demand (about 3,000 hours per year), when their relatively low efficiency is not as great a concern. Applying the review methodology, this technology is commercially available, and could be implemented. The cost of generation is relatively high, approximately 5.5 to 7.5 cents per kilowatt-hour, depending on fuel costs. However, this technology typically is used to generate electrical power during peak-demand periods, when electricity costs are typically higher. Therefore, this technology satisfies Steps 1, 2, and 3.

9.6.2.3 Conventional Combined-Cycle

This technology integrates combustion turbines and steam turbines to achieve higher efficiencies. The combustion turbine, which drives a generator, would normally exhaust its hot combustion gas to the atmosphere. However, in the combined-cycle technology, the exhaust gas is passed through a heat recovery steam generator creating steam that is used to drive a steam turbine/generator. The resulting efficiency for the system is 50 to 54 percent, which is considerably greater than most other alternatives. In addition, natural gas fuel emits little sulfur dioxide and little particulate matter. For these reasons, the system is considered the benchmark against which all other base load technologies are compared. Applying the review methodology, this technology is commercially available, but cannot be implemented due to the long startup periods required to preheat the steam transfer equipment and steam turbine. Therefore, this technology fails Step 2 and was rejected from further consideration.

9.6.2.4 Kalina Combined-Cycle

This technology is similar to the conventional combined-cycle except water in the heat recovery boiler is replaced with a mixture of water and ammonia. Overall efficiency is expected to be increased 10 to 15 percent. However, this technology is still in the testing phase, with tests recently completed on a 3-MW unit in Southern California. Applying the review methodology, the technology fails to pass Step 1 because it is not commercially available, and therefore, was eliminated from consideration.

9.6.2.5 Advanced Gas Turbine Cycles

There are numerous efforts to enhance the performance and/or efficiency of gas turbines by injecting steam, intercooling, and staged firing. These include the steam-injected gas turbine (SIGT), the intercooled steam-recuperated gas turbine, the chemically recuperated gas turbine, and the humid air turbine cycle. With the exception of the SIGT, none of the technologies are commercially available, and therefore, fail to pass Step 1 of the review methodology. The SIGT is marginally commercially available and does not pass Steps 1 and 2. Consequently, this technology was eliminated from consideration.

9.6.2.6 Fuel Cells

This technology uses an electrochemical process to combine hydrogen and oxygen to liberate electrons, thereby providing a flow of current. The types of fuel cells include phosphoric acid, molten carbonate, solid oxide, alkaline, and proton exchange membrane. With the exception of the phosphoric acid fuel cell and possibly the molten carbonate fuel cell, none of these technologies are commercially available, and therefore, fail Step 1. The phosphoric acid fuel cell has been operated in smaller-size units, and the molten carbonate fuel cell has completed testing. However, currently neither of these technologies are cost-competitive with conventional simple-cycle technology, and therefore, fail Step 3 of the review methodology.

9.6.2.7 Water

These technologies use water as "fuel" and include geothermal. Other water technologies (hydroelectric and ocean energy conversion) were excluded due to the inherent limitations in these technologies to provide peaking electrical generation.

9.6.2.8 Geothermal

These technologies use steam or high-temperature water (HTW) obtained from naturally occurring geothermal reservoirs to drive steam turbine/generators. Vapor-dominated resources (dry, super-heated steam) and liquid-dominated resources HTW use a number of techniques to extract energy from the HTW. Geothermal is a commercially available technology. However, geothermal resources are limited, and most, if not all, economical resources have been discovered and developed in California. Therefore, this technology fails Steps 2 and 3.

9.6.2.9 Solar Radiation

Solar radiation (sunlight) can be collected directly to generate electricity with solar thermal and solar photovoltaic technologies, or indirectly through wind generation technology in which the sunlight causes thermal imbalance in the air mass, thereby creating wind. Wind generation and two types of solar generation, thermal conversion and photovoltaics, were considered as alternative technologies to the simple-cycle. These are described in the following subsections.

9.6.2.10 Thermal

Most of these technologies collect solar radiation, heat water to create steam, and use the steam to power a steam turbine/generator. The primary systems that have been used in the United States capture and concentrate the solar radiation with a receiver. The three main receiver types are mirrors located around a central receiver (power tower), parabolic dishes, and parabolic troughs. Another technology collects the solar radiation in a salt pond and then uses the heat collected to generate steam and drive a steam turbine/generator. While one of these technologies might be considered to be marginally commercial (parabolic trough), the others are still in the experimental stage.

All of these technologies require considerable land for the collection receivers and are best located in areas of high solar incidence. In addition, power is only available while the sun shines; therefore, the units do not supply power when clouds obscure the sun or from early evening to late morning. These factors translate into high cost, approximately 6 to 12 cents per kilowatt-hour, which is well above the future projected market price for peaking power. These systems for the most part fail Step 1, commercial availability, and may not be implementable due to land unavailability and/or the ability to finance (Step 2). However, they all fail in being cost-effective (Step 3), and therefore, were eliminated from consideration.

9.6.2.11 Photovoltaic

This technology uses photovoltaic “cells” to convert solar radiation directly to direct current electricity, which is then converted to alternating current. Panels of these cells can be located wherever sunlight is available. This technology is environmentally benign and is commercially available, because panels of cells can theoretically be connected to achieve any desired capacity. While this technology may have a bright future, currently the cost is very high, approximately 15 to 25 cents per kilowatt-hour. The technology fails Step 3, cost-effectiveness, and therefore, was eliminated from consideration.

9.6.2.12 Wind Generation

This technology uses a wind-driven rotor (propeller) to turn a generator and generate electricity. Only certain sites have adequate wind to allow for the installation of wind generators, and most of the sites that have not been developed are remote from electric load centers. Capacity from this technology is not always available because even in prime locations the wind does not blow continuously. In California, the average wind generation capacity factor has been 15 to 30 percent. In addition, the technology cannot be depended upon to be available at system peak load because the peak may occur when the wind is not blowing. The technology is commercially available and probably implementable at the proposed sites, although financing may not be available due to its perceived risk. The technology is relatively benign environmentally although visual impacts, land consumption, and effects on raptors are a concern. The cost of generation is approximately 5 to 10 cents per kilowatt-hour, which is above the cost of the preferred alternative. The technology fails Step 3, cost effectiveness, and therefore was eliminated from consideration.

9.6.3 Conclusions

All feasible technologies that might be available for peaking load operation in California were reviewed using a methodology that considered commercial availability, ability to implement, and cost-effectiveness. Although some technologies, other than the simple-cycle burning natural gas, were commercially available and could be implemented, most would not result in fewer environmental effects than the natural gas-fired, simple-cycle. In addition, for all alternatives commercially available, implementable technologies were less cost-effective than the simple-cycle, and therefore, would not be consistent with MID's fiduciary duty to provide low-cost power for its customer-owners. Consequently, the conventional simple-cycle technology using natural gas as fuel is the best available technology for a peaking plant and the one that should be employed for MEGS.

9.7 References

CEC (California Energy Commission). 1995. 1994 Biennial Electricity Report (ER94), P300-95-002. November.

CEC (California Energy Commission). 2001. Decision Mitigated Negative Declaration and Revised Initial Study for the Woodland Generating Station II. September.

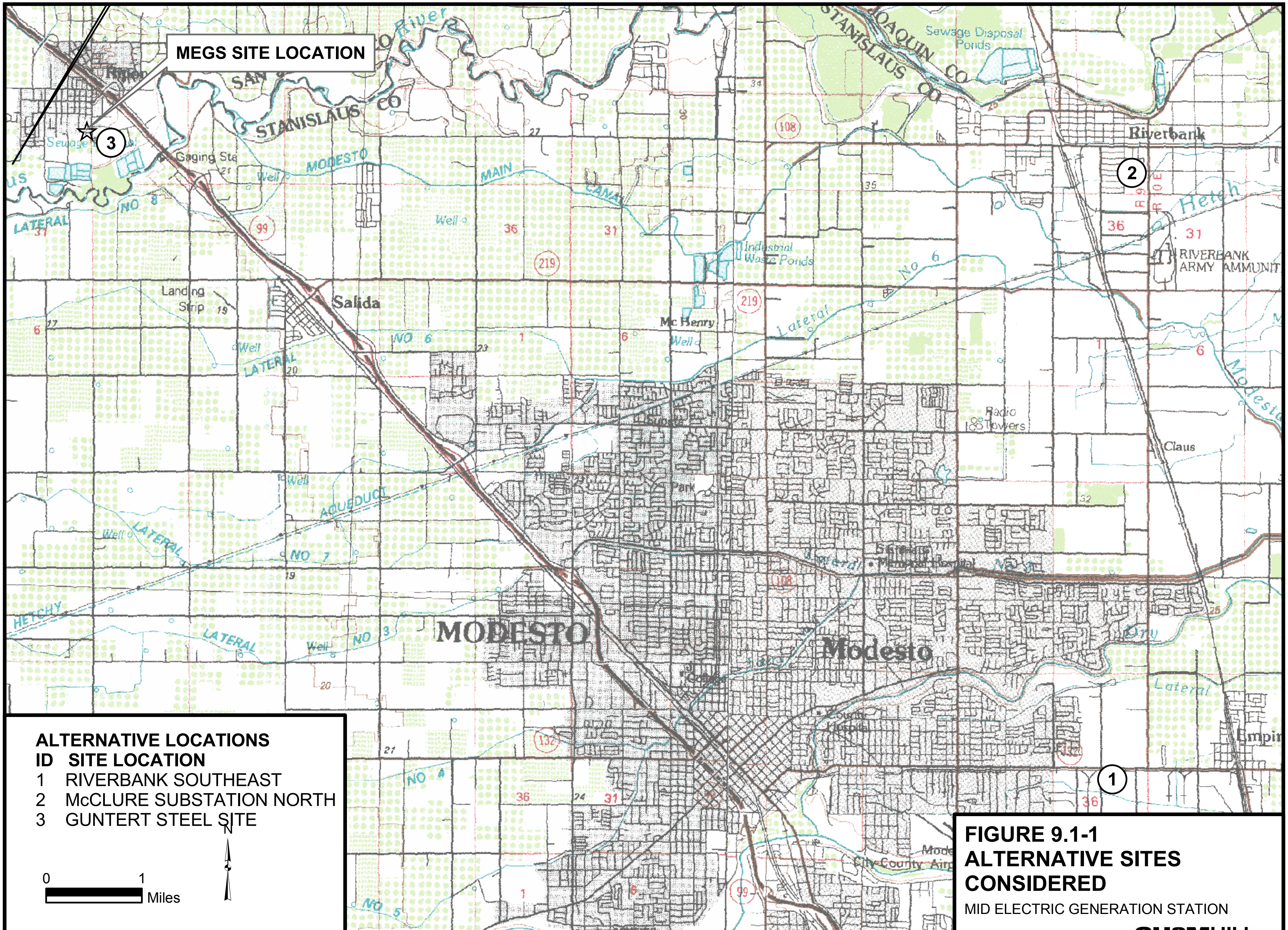

FIGURE 9.1-1
ALTERNATIVE SITES CONSIDERED

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